

Bosch Rexroth Limited,
Cromwell Road, St. NEOTS PE19 2ES

Cairngorm Mountain Ltd
Aviemore
Scotland
PH22 1RB

For the attention of [REDACTED]

Service Visit Report

Site Address:	Aviemore, PH22 1RB
Customer Order Number:	2382
Visit Date:	4-7 December 2013
Job Number:	4337239
Bosch Rexroth Engineer:	[REDACTED]

Equipment Type:	
Serial Number:	
Identification Number:	

Reason for Visit

Carry out annual maintenance checks.

Work Carried Out

Annual service work carried out as follows:

Top Brake

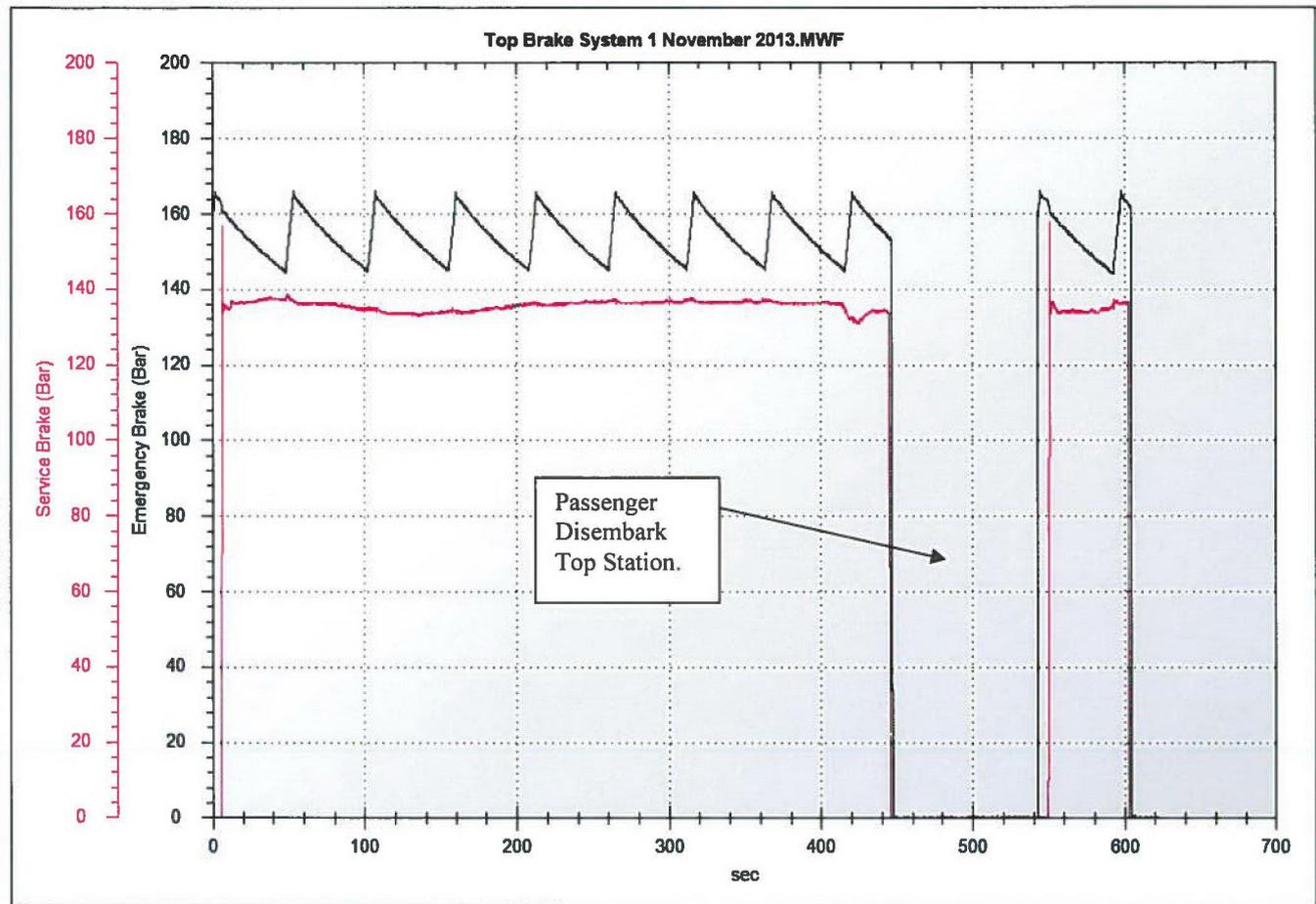
- Carried out inspection of the system.
- Pipework and hoses in good condition. No leaks.
- New filter elements fitted to items 5 and 34. **0030 D 010 BN4HC**.
- Accumulator precharge checked: Item 27 & 56 precharge found to be 90 bar. Item 63 found to 65 bar. All as per circuit.
- Written scheme of examination carried out on accumulators (See attached sheet).
- Relief valve item 62 checked via hand pump and operated at 210 bar as per circuit.
- Relief valves 7 and 36 checked by increasing pressure in items 6 and 35 to above 200 bar to witness relief valves operating at 200 bar as per circuit. Items 6 and 35 reset back to original settings (See trace

Work Carried Out

for settings).

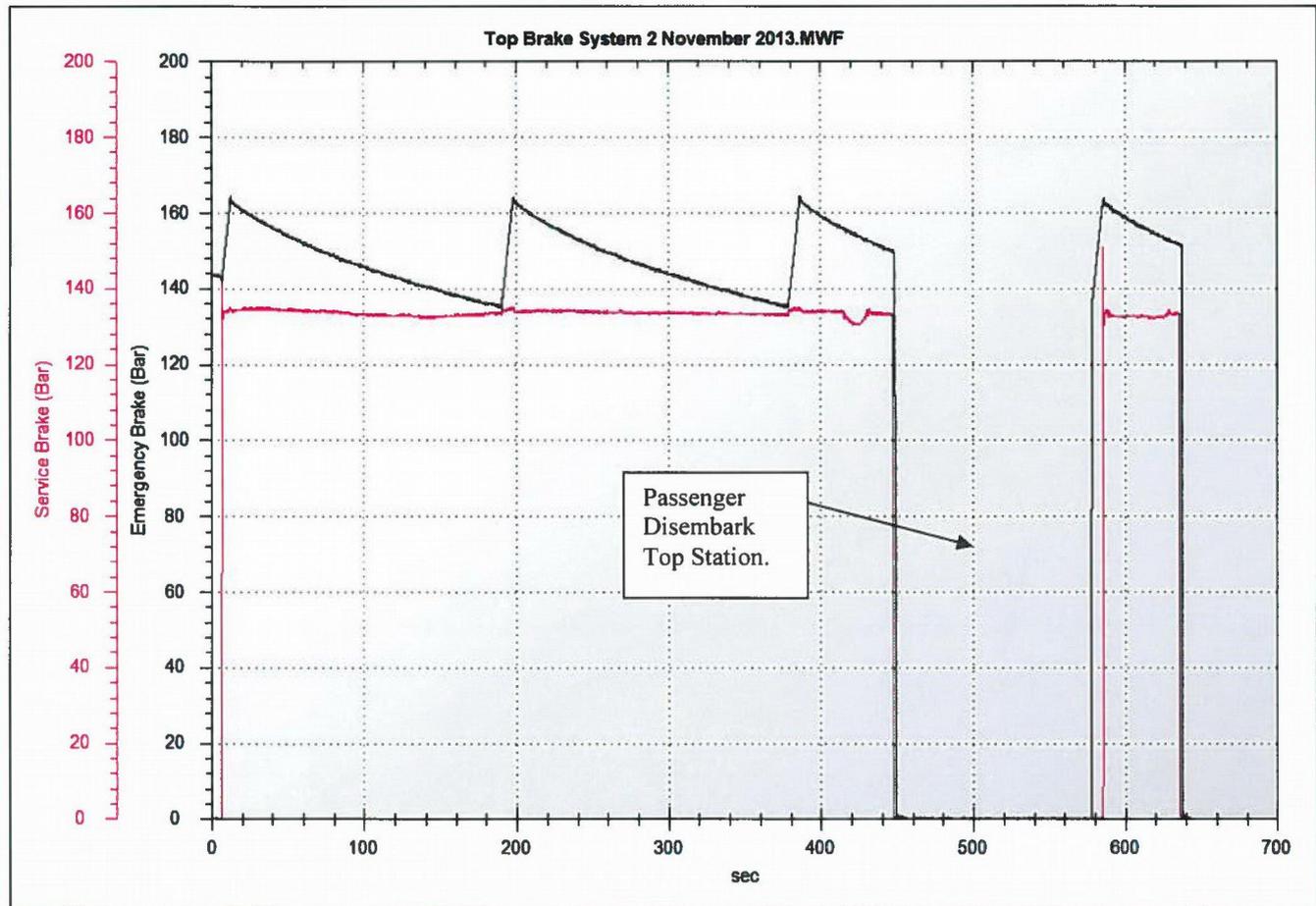
- Traces taken for both systems as shown below.

System 1.



Work Carried Out

System 2

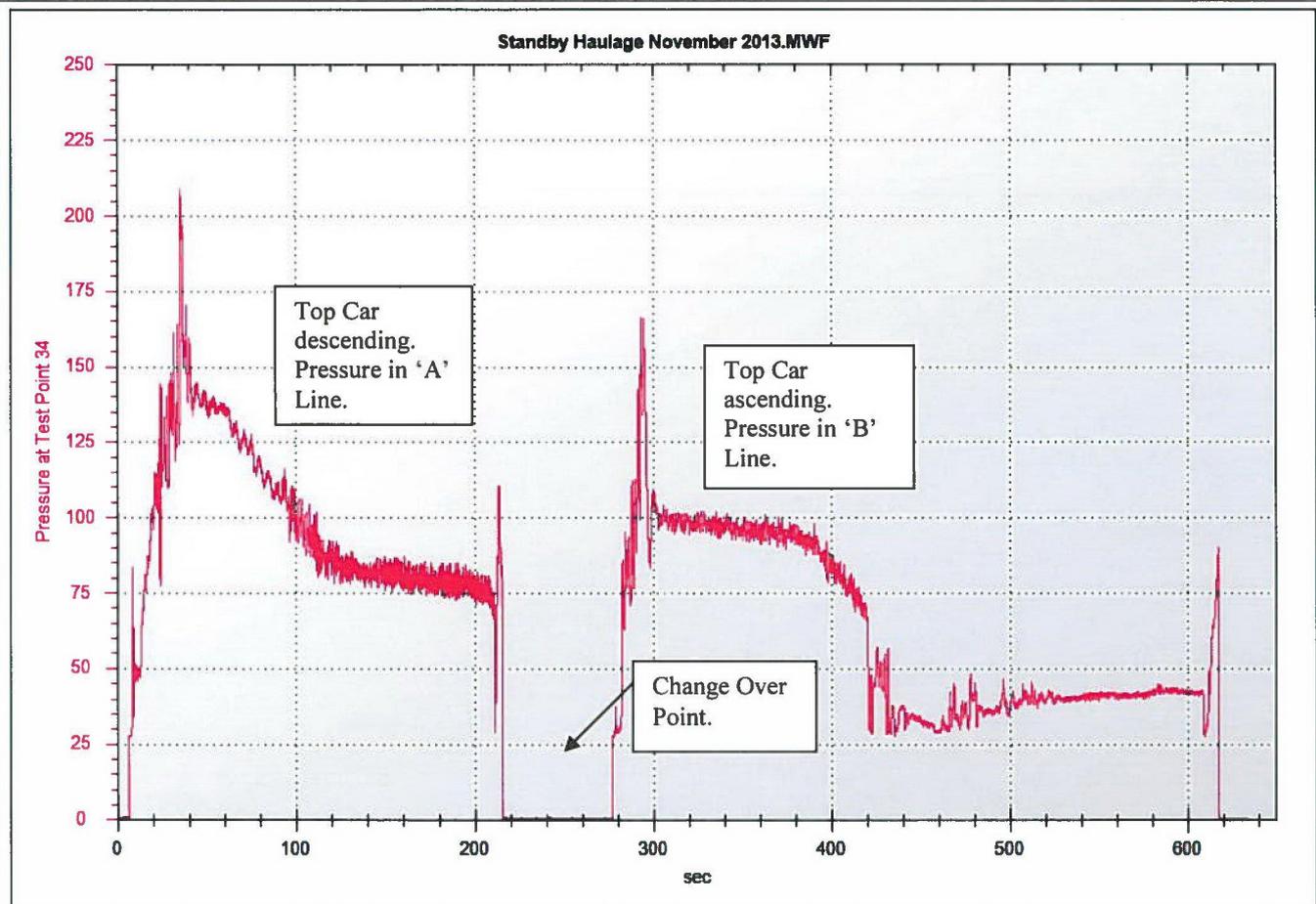


- Oil sample taken from reservoir to be sent off for analysis. Oil used: Mobil DTE 13M ISO VG32. (see attached laboratory report number 4539750). Oil cleanliness grade of 16/13/10 in accordance with ISO 4406 is acceptable for this system.

Standby Haulage

- Carried out visual inspection of system.
- Pipework and hoses in good condition, no leaks found.
- Filter canister changed.
- Diesel engine started and system run.
- Boost pressure reading 30 bar as per circuit.
- Cooler pump pressure reading 3.1 bar.
- System operated with cars empty. Top car moved down to the tunnel mouth and then returned back to station. Car speed 1.6 m/sec.
- Pressure trace taken at test point 34.
- Pressure in returning side of the pump read at 20 bar for both directions of travel. See trace for maximum pressures.

Work Carried Out



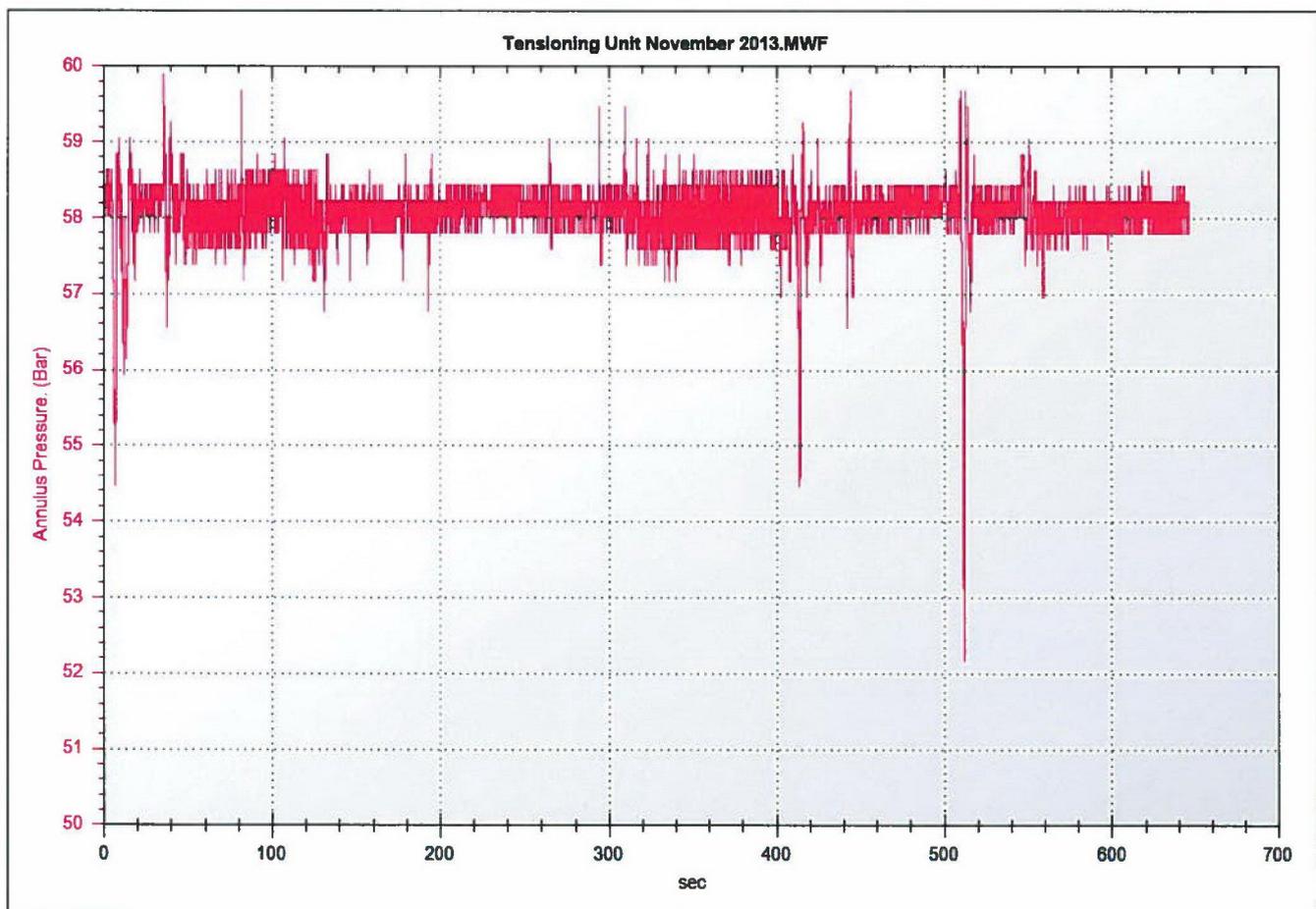
- Oil sample taken from reservoir to be sent off for analysis. Oil used: Mobil DTE15M ISO VG46. (see attached laboratory report number 4539752). The oil cleanliness grade of 20/17/13 is acceptable, however borderline for this system. We recommend re-sampling again in 3 months time

Vehicle Brake (both cars)

- It was reported that Car 2 pressure drops frequently and the pump keeps coming on to re-charge the system (every 15 minutes approximately). The system was checked on the last visit and no obvious leak was found. The power unit was checked for any internal leaks across valves but none could be found. This only left the valves that are situated on the brakes themselves. A new set of valves have been ordered and are awaiting delivery. When these arrive, another visit is to be arranged for fitting and commissioning.
- Carried out visual inspection of system. Hoses and pipework in good condition. No leaks found.
- Accumulators checked and found to be both pre-charged to 120 bar.
- Replacement filter element, item 2.9, fitted to both cars. **0030 D 010 BN4HC**.
- Replacement air breather, item 1.3, fitted to both cars.
- Hand pump operation checked ok.
- Operation of relief valve, item 2.2, checked and found to be set at 330 bar as per circuit.
- Written scheme of examination carried out on accumulators (see attached).
- Oil sample taken from both reservoirs to be sent off for analysis. Oil used: Environ MV32 Petro-Canada. (see attached laboratory report number 4539749). The oil cleanliness grade of 20/18/13 in accordance with ISO 4406 is acceptable.

Work Carried Out**Rope Tension**

- It had been reported that the system had tripped a couple of times due to loss of pressure over a few months. It was decided, that as the pump had been in place for 4 years and runs all day, every day, without being unloaded, that the pump should be swapped out for the spare, reconditioned pump. This was done and the pump started without any problems. The old pump has been taken away for inspection and refurbishment.
- Carried out visual inspection of the system. Pipework and hoses in good condition. No leaks found.
- Replacement filter element, item 12, fitted. **0110 R 010 BN4HC**.
- Replacement air filter fitted to item 1.6. **0060 D 020 BN3HC**.
- Seals of item 40 checked by monitoring pressure lock in annulus of cylinder. Seals ok.
- Pressure trace taken for complete journey of cars at port 'Z' test point item 45.



- Oil sample taken from reservoir to be sent off for analysis. Oil used: Mobil DTE 13M ISO VG32. (see attached laboratory report number 4539751). The oil cleanliness grade of 19/16/11 in accordance with ISO 4406 is acceptable for this system.

M1 and Day Lodge Poma Tow Lift.

- Both assemblies had replacement hoses fitted from the annulus port to accumulator fittings as the original hoses were found to be too short.
- New hose fitted on to 'Day Lodge' assembly from accumulator relief valve tank line to tank line tee on full bore port. This was a replacement for a temporary slave hose used for installation.

Work Carried Out

- Both accumulator relief valves removed from housing and settings checked using separate hand pump and slave housing. Both valves found to be set at 315 bar as per previous setting. Valves replaced ok.
 - Gas pressure checked on 'M1' assembly and found to be 100 bar. This wants topping up to 110 bar but not enough gas on site to do this. This will require topping up on the next visit as well as checking and possibly topping up 'Day Lodge' precharge.
 - Both systems tested ('M1' pressure to 100 bar, 'Day Lodge' pressure to 90 bar) ok.
 - Hose burst valves checked ok as per Poma manual.
- As detailed in last visit report from July 2013, all the hoses on the 'Diesel Standby', 'Top Brake' and 'Tensioning Unit' should be replaced as they are now over ten years old. Hose lengths taken and hose details taken down to quote for new.

Recommended Further Work

- Accumulators to be topped up where required as detailed.
- Car 2 brake valves to be replaced as detailed.
- Another set of car brake valves to be ordered for spares (Order No. 2500).
- Quote for replacement hoses.
- Quote to replace pipework at back of 'Top Brake' to stainless steel.

Equipment Returned:	Tensioning Pump
Part Number:	SYDFEE20/071R-PPA12KC1-0000-A0A0CXX
Serial Number:	31977420

Authorised By:	
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Report on the findings of the inspection of the pressure systems under this written scheme of examination.

User/ Owner: Cairngorm Mountain Railway

Examination No. 4337239

Item no.	Safe for continued use?		Date of next examination	Comments
	Yes	No		
1	✓		N/A	To be replaced Nov 2014
2	✓		N/A	To be replaced Nov 2014
3	✓		N/A	To be replaced Nov 2014
4	✓		N/A	To be replaced Nov 2014
5	✓		N/A	To be replaced Nov 2014
6	✓		N/A	To be replaced Nov 2014
7	✓		N/A	To be replaced Nov 2014
8	✓		N/A	To be replaced Nov 2014
9	✓		N/A	To be replaced Nov 2014
10	✓		N/A	To be replaced Nov 2014
11	✓		November 14	To be replaced 2017
12	✓		November 14	To be replaced 2018

I certify that the equipment itemised above and detailed in the equipment schedule and the accumulator log has been examined and tested as specified in the Service and Repair Manual Procedures to meet the requirements of the Pressure Systems and Transportable Gas Regulation 1989.

On Behalf of: Bosch Rexroth Ltd

Competent Person:



Date: 6-11-13

Hydro-Pneumatic Accumulator Log

Owner/User: Cairngorm Mountain Railway
Site: Aviemore

Examination No: 4337239

Item No.	Location	Accr Type	Manufacturer	Part no.	Serial no.	Design Standard	Date of Manufacture	Max W.P. Bar	Test pressure Bar	Nominal Volume litres	System Pressure Bar	Bar X Litres Rating	Type of examination & test			Frequency in years					
													Internal	External	Pressure	1	2	3	4	5	
1	Top Brake Item 27	B	Hydac	SB330 10A1/112 U-345	CO18033		2009	345	495	10	144										
2	Top Brake Item 56	B	Hydac	SB330 10A1/112 U-345	CO20070		2009	345	495	10	136										
3	Top Brake Item 53	B	Hydac	SB330 5A1/112 U-345A	315637		2009	345	495	5	140										
4	Car 1 Item 4	B	Hydac	SB330 01A1/112 K-345A	288771		2009	345	495	1	330										
5	Car 2 Item 4	B	Hydac	SB330 01A1/112 K-345A	331827		2009	345	495	1	330										
6	Top Brake Item 7		Bosch Rexroth	DBDS6K1 X/200				200	200												
7	Top Brake Item 36		Bosch Rexroth	DBDS6K1 X/200				200	200												
8	Top Brake Item 62		Bosch Rexroth	DBDS6K1 X/200				200	200												
9	Car 1 Item 2.2		Bosch Rexroth	DBDS6K1 X/300B				330	330												
10	Car 2 Item 2.2		Bosch Rexroth	DBDS6K1 X/300B				330	330												
11	M1 Poma	B	Hydac	SB330-20A1/6650 U-330A	1637 05/2012		2012	345	495	20	100										
12	Day/dodge Poma	B	Hydac	SB330-20A1/665 U-330A	471919		2013	330	495	20	90										

Inspectors Comments:-

Item 11 pre-charged to 105 bar to be topped up.
Item 12 to be checked and topped up if required.

Test requirements

H = Hydrostatic
V = Volumetric Exp.
N/A = No Examination
Below 250 bar litres

Accumulator Types

B = Bladder
P = Piston
D = Diaphragm

General Description of system/systems System type and environmental Matrix

The system/systems described in this document fall under the category B in the matrix below

Category of System	System Type	Environment	Examination periodicity	Examination/Test Type
A	Non-Corrosive Liquid	Normal room temperature. No risk of external damage.	5 Yearly check of system safety features. e.g. relief valves.	10 Yearly external and internal. Plus hydrostatic pressure test.
B	Non-Corrosive Liquid	High humidity. High/Low temperatures	5 Yearly check of system safety features.	5 Yearly external and internal. Plus hydrostatic pressure test.
C	Non-Corrosive Liquid	Corrosive environment. e.g. Salt Spray	Annual check of system safety features	Annual external plus 2 yearly internal plus hydrostatic pressure test

It is the responsibility of the responsible/competent person to define the type and periodicity of examination and tests to be carried out.

The above table gives an indication of the recommendations.

For the various combinations of system and environment the examination periodicity will be defined accordingly.

Make:		Sample No:	4539752
Model:		Location:	
Serial No:	DIESEL STANDBY	Client:	
System:	HYDRAULIC	Form No:	HT108252
Brand:	MOBIL DTE 15M	Job No.:	
Grade:	46	Sampled:	06/11/13
Unique No.:	1923285	Received:	15/11/13

Diagnosis	Diagnostician: Sean George	Normal	Caution	Serious
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Wear appears satisfactory. No significant contamination. Advise monitor at the recommended sampling period.



Results	Current Sample	Historical Samples
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Sample No	4539752	4089087
Status	✓	⬛
Sampled	06/11/13	22/05/2012
Fluid Age		-1
Machine Hrs:		-1

Fluid condition & other tests

Viscosity @ 40 °C	mm2/s	42.3	42.1
Water %	%	<0.1	<0.1
App	-	10	70
Neut No.	mg[KOH]/g	0.35	
ISO Code	-	20/17/13	19/17/12
Particle Count 14	particles/ml	42	
Particle Count 4	particles/ml	5152	
Particle Count 6	particles/ml	796	

Wear Metals

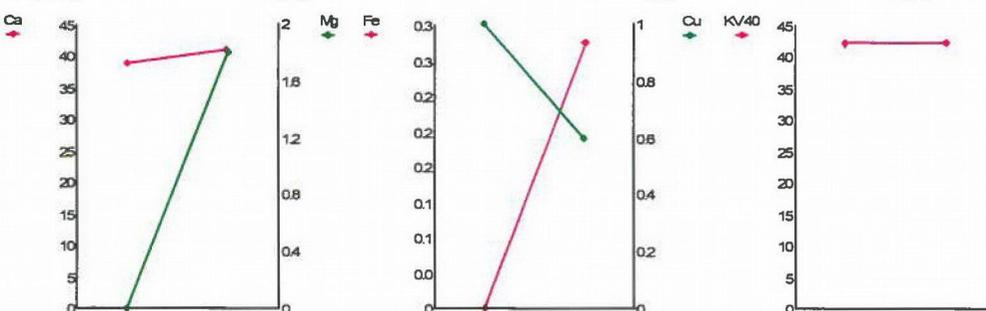
Al (Aluminium)	mg/kg	0.3	0
Sn (Tin)	mg/kg	0.1	2
Pb (Lead)	mg/kg	2.5	1
Cu (Copper)	mg/kg	0.6	1
Fe (Iron)	mg/kg	0.3	0
Cr (Chromium)	mg/kg	0.0	0
Mo (Molybdenum)	mg/kg	0.2	0
Ag (Silver)	mg/kg	0.0	0
Ni (Nickel)	mg/kg	0.0	1
Mn (Manganese)	mg/kg	0.1	0

Contamination

Na (Sodium)	mg/kg	0.0	4
Si (Silicon)	mg/kg	0.6	1
(Lithium)	mg/kg	0.0	0
Overall SAE Code	-	10	

Additives

B (Boron)	mg/kg	0.0	0
Ba (Barium)	mg/kg	1.3	1
Ca (Calcium)	mg/kg	41	39
Mg (Magnesium)	mg/kg	1.8	0
P (Phosphorus)	mg/kg	359	280
S (Sulphur)	mg/kg	2274	1861
Zn (Zinc)	mg/kg	509	359





Filtertechnik

Filtration, Purification & Separation Solutions

Fluid Analysis Laboratory
Conwy
LL32 8FA
United Kingdom
Tel: 01492 574750

Make:		Sample No:	4539751
Model:	4337239	Location:	
Serial No:	TENSIONING UNIT	Client:	
System:	HYDRAULIC	Form No:	HT108255
Brand:	MOBIL DTE 13M	Job No.:	
Grade:	32	Sampled:	06/11/13
Unique No.:	1923290	Received:	15/11/13

Diagnosis Diagnostician: Sean George Normal Caution Serious

Wear appears satisfactory. No significant contamination. Advise monitor at the recommended sampling period.



Results	Current Sample	Historical Samples
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Sample No	4539751	4089091
Status	✓	✓
Sampled	06/11/13	23/05/2012
Fluid Age		-1
Machine Hrs.		-1

Fluid condition & other tests

Viscosity @ 40 °C	mm2/s	28.9	28.3
Water %	%	<0.1	<0.1
App	-	10	10
Neut No.	mg[KOH]/g	0.92	
ISO Code	-	19/16/11	18/16/13
Particle Count 14	particles/ml	16	
Particle Count 4	particles/ml	2938	
Particle Count 6	particles/ml	365	

Wear Metals

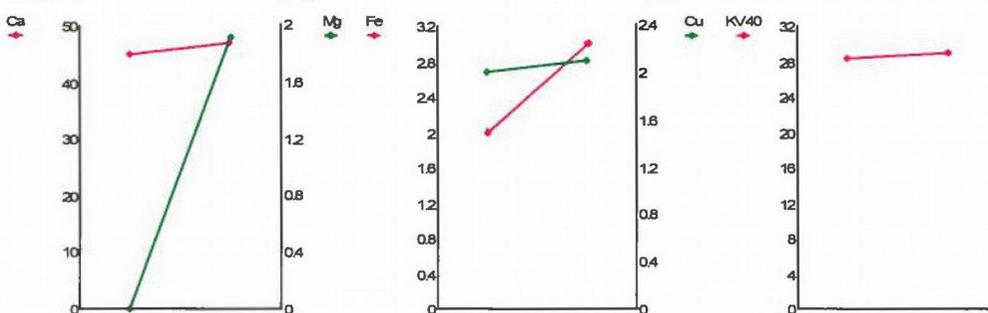
Al (Aluminium)	mg/kg	0.8	0
Sn (Tin)	mg/kg	1.4	0
Pb (Lead)	mg/kg	2.6	2
Cu (Copper)	mg/kg	2.1	2
Fe (Iron)	mg/kg	3.0	2
Cr (Chromium)	mg/kg	0.0	0
Mo (Molybdenum)	mg/kg	0.0	0
Ag (Silver)	mg/kg	0.0	0
Ni (Nickel)	mg/kg	0.0	1
Mn (Manganese)	mg/kg	0.1	0

Contamination

Na (Sodium)	mg/kg	0.0	9
Si (Silicon)	mg/kg	0.8	1
Li (Lithium)	mg/kg	0.0	0
Overall SAE Code	-	9	

Additives

B (Boron)	mg/kg	0.2	0
Ba (Barium)	mg/kg	30	27
Ca (Calcium)	mg/kg	47	45
Mg (Magnesium)	mg/kg	1.9	0
P (Phosphorus)	mg/kg	670	537
S (Sulphur)	mg/kg	3532	2852
Zn (Zinc)	mg/kg	858	646



Make:		Sample No:	4539749
Model:		Location:	
Serial No:	CARI	Client:	
System:	HYDRAULIC	Form No:	HT108251
Brand:	PETRO CANADA ENVIRON MV	Job No.:	
Grade:	32	Sampled:	06/11/13
Unique No.:	4023681	Received:	15/11/13

Diagnosis Diagnostician: Sean George Normal Caution Serious

Viscosity not consistent with stated grade. Wear appears satisfactory. Advice : Resample at the next service intervention. Confirm oil grade required.



Results Current Sample Historical Samples

Sample No	4539749
Status	
Sampled	06/11/13
Fluid Age	
Unit Age	

Oil condition & other tests

Viscosity @ 40 °C	mm2/s	15.2
Water %	%	<0.1
App	-	10
Neut No.	mg[KOH]/g	0.49
ISO Code	-	20/18/13
Particle Count 14	particles/ml	84
Particle Count 4	particles/ml	6647
Particle Count 6	particles/ml	1448

Wear Metals

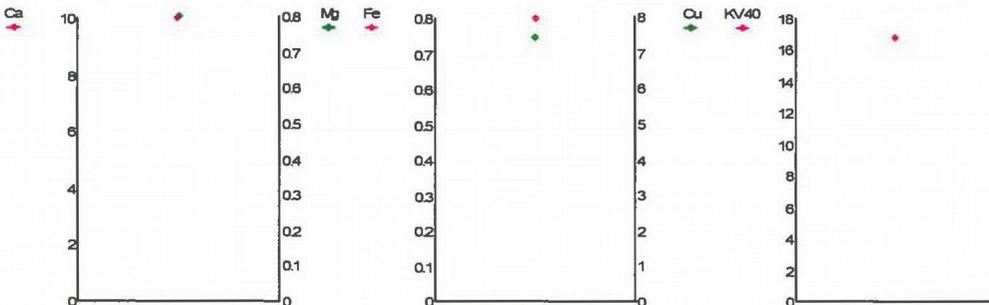
Al (Aluminium)	mg/kg	0.0
Sn (Tin)	mg/kg	1.0
Pb (Lead)	mg/kg	4.3
Cu (Copper)	mg/kg	7.4
Fe (Iron)	mg/kg	0.8
Cr (Chromium)	mg/kg	0.0
Mo (Molybdenum)	mg/kg	0.0
Ag (Silver)	mg/kg	0.1
Ni (Nickel)	mg/kg	0.0
Mn (Manganese)	mg/kg	0.2
V	mg/kg	0.0
Cd	mg/kg	0.2

Contamination

Na (Sodium)	mg/kg	0.0
K (Potassium)	mg/kg	0.0
Si (Silicon)	mg/kg	0.6
Li (Lithium)	mg/kg	0.0
Overall SAE Code	-	10

Additives

B (Boron)	mg/kg	0.0
Ba (Barium)	mg/kg	10
Ca (Calcium)	mg/kg	10
Mg (Magnesium)	mg/kg	0.8
P (Phosphorus)	mg/kg	332
S (Sulphur)	mg/kg	3263
Zn (Zinc)	mg/kg	377



Make:		Sample No:	4539754
Model:		Location:	
Serial No:	CAR 2	Client:	
System:	HYDRAULIC	Form No:	HT108253
Brand:	CASTROL ENDURON MV	Job No.:	
Grade:	32	Sampled:	08/11/13
Unique No.:	4023688	Received:	15/11/13

Diagnosis Diagnostician: Sean George **Normal** **Caution** **Serious**

Viscosity not consistent with stated grade. Wear appears satisfactory. Advice : Resample at the next service intervention. Confirm oil grade required. Insufficient sample to carry out all tests.



Results Current Sample Historical Samples

Sample No	4539754
Status	
Sampled	08/11/13
Fluid Age	
Unit Age	

Fluid condition & other tests

Viscosity @ 40 °C	mm2/s	17.4
Water %	%	<0.1
App	-	10

Wear Metals

Al (Aluminium)	mg/kg	0.0
Sn (Tin)	mg/kg	0.0
Pb (Lead)	mg/kg	5.1
Cu (Copper)	mg/kg	6.2
Fe (Iron)	mg/kg	0.3
Cr (Chromium)	mg/kg	0.0
Mo (Molybdenum)	mg/kg	0.0
Ag (Silver)	mg/kg	0.0
Ni (Nickel)	mg/kg	0.7
Mn (Manganese)	mg/kg	0.1

Contamination

Na (Sodium)	mg/kg	6.4
Si (Silicon)	mg/kg	0.7
Li (Lithium)	mg/kg	0.2

Additives

B (Boron)	mg/kg	0.0
Ba (Barium)	mg/kg	16
Ca (Calcium)	mg/kg	9.2
Mg (Magnesium)	mg/kg	0.9
P (Phosphorus)	mg/kg	370
S (Sulphur)	mg/kg	3149
Zn (Zinc)	mg/kg	407

